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Supply Chains Built for Speed and Customization

Abstract: As emerging technologies like 3-D printing begin to bring personalized manufacturing to scale, a new supply chain model is following suit.

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The newest wave of digital customer engagement is developing in one of the oldest of industries: manufacturing. Thanks to emerging technologies like 3-D printing, manufacturers can offer consumers customized products and do so with unprecedented speed. Intrigued by a new product you saw in a YouTube video? Well, soon you may be able to personalize it, order it via the company's website, and have it in your hands in a matter of days.

We are seeing this phenomenon emerge in a variety of consumer product sectors, including personalized running shoes pioneered by the likes of Adidas AG and Nike Inc.

Mass customization is finally here, now backed with a new kind of supply chain.

Across product categories, we find companies engaging with customers online and inviting them to customize and order products from a company website. Orders are produced quickly — in factories using 3-D printing and robotics located close to the customer — and delivered quickly via the highest-speed options available.

We call these new supply chains *high-speed bespoke supply chains*, because they provide both quickness and product customization. And while the emergence of this new model is a phenomenon of manufacturing and fulfilment of personalized products, its value extends to rarely ordered products as well. High-speed bespoke supply chains also offer the promise of unprecedented market intelligence for manufacturers by capturing demand signals directly from online end-customers about specific features in existing products and prototypes.

These manifold opportunities also bring new challenges for manufacturers, who will need to strategically integrate a wholly new supply chain model into their operations.

A New Supply-Chain Option

Having the right type of base supply chain — one that is lean for cost-efficiency or agile for time-efficiency — is well-understood by manufacturers. It is a choice that depends on whether the products are *functional* goods (commodities) for which cost matters most, or

fashion goods (innovative products) for which time to market is critical. Leading companies split their supply chains between the two types of products: for its European customers, Spanish clothing retailer Zara makes fashion goods in Europe itself to be shipped quickly via truck, while sourcing functional goods from China or India to be shipped by sea.

High-speed bespoke supply chains add a third option to this framework. Whether a company employs a lean supply chain or an agile supply chain or a combination of both, its operations are meant to be optimized for *make-to-stock* products based on forecasts. By contrast, high-speed bespoke supply chains fit the needs of *make-to-order* products based on realized demand, not forecasts.

There's another advantage to extending the lean-agile framework with a high-speed bespoke supply chain: Supply chain managers gain a potentially more cost-effective option for fulfilling ultra-low-volume items, such as replacement parts for outdated product models. Instead of relying on lean or agile supply chains to fulfill orders for products with low, sporadic demand from a slow-turning inventory of goods, finished or semi-finished, or manufacturing fixtures, companies could fulfill orders by high-speed bespoke supply chains. German automaker Daimler AG, for instance, is experimenting with 3-D printed plastic spare parts for Mercedes-Benz trucks, no matter how old the model. By moving these replacement parts to on-demand production, the company not only decreases inventory but also is able to retire a large number of molds and related equipment. Without this overhead, an order can be fulfilled from the nearest of the

company's manufacturing or development locations worldwide with 3-D printing.

Developing a high-speed bespoke supply chain also allows marketers to add more product variety with niche demand, fattening the so-called "long tail" of product demand to reap additional profits in the same way Apple does with iTunes.

Although unit manufacturing costs in a high-speed bespoke supply chain are higher than in the base (lean or agile) supply chain, the total supply chain's cost per unit can be lower for products with low levels of sporadic demand because manufacturing-complexity-related, inventory-related and transportation-related costs are greatly reduced. And for customized products, customers have shown their willingness to pay more — sometimes much more — for products they've shaped themselves.

Finally, the high-speed bespoke supply chain is premised on manufacturing facilities close to customers for quick delivery and therefore onshore. Thus, high-speed bespoke supply chains translate into in-country manufacturing jobs, which are being demanded by governments in many countries, including the U.S. The bulk of manufacturing however would remain in the base supply chains that originate in low-cost offshore locations because custom unit sales will remain a small but valuable portion of overall unit sales.

The Model in Action

Some leading global manufacturers have already begun experimenting with high-speed

bespoke supply chains. Sports apparel company Adidas, which offers customization of its shoes through its Mi Adidas ("my Adidas") online platform, has built its first "Speedfactory" in Germany to add high-speed manufacturing to its bespoke product offering. The company plans to open additional Speedfactories in western countries such as one in Atlanta, Georgia in 2017. While the company will continue to order over 300 million standard pairs of shoes a year from its Asian contractors in its base supply chain, it wants the Speedfactories to be able to produce an estimated 1 million customer-designed pairs of shoes a year to meet high-priced bespoke demand in western countries.

Adidas plans to dramatically slash the time between custom orders and delivery with these Speedfactories to four to five business days from the 4-6 weeks it currently takes with Mi Adidas. A customer would design and order a dream pair of shows on Monday, and receive the pair on Friday. The company would be monitoring its customers' creations on the web, whether wish listed or actually ordered – if particular designs or features recur at high enough rates, the company can incorporate these features into standard shoes in the base supply chain. Personalized orders thus offer insight into customers' desires.

Nike Inc. also offers customization with its NikeiD program for shoes to be customized and ordered via its website for delivery in 3-5 weeks. According to Nike chief operating officer Eric Sprunk, the eventual plan however is for customers to be able to walk into a Nike store and have a 3-D-printed shoe made within a matter of hours: a very short high-speed bespoke supply chain!

In the toy industry, Mattel Inc. is tapping into the maker movement and bringing on-demand manufacturing directly into customers' homes (essentially giving people their own at-home, high-speed bespoke supply chain) via a microwave-size, 3-D printer and computer app for children called ThingMaker. Set for release in fall 2017, the package's app will let a child customize toys such as dinosaurs, robots, and dolls and then send the resulting stereolithography file to the 3-D printer. The parts will be printed with ball-and-socket joints to be assembled by the child.

Although Mattel's idea is for customers to create their own stereolithography files, nothing stops Mattel from offering retired models and "trial balloons" as stereolithography files for 3-D printing at home. Analyzing orders for these files (and customizations by children) would help the company spot new market trends and bet on potential winners more confidently when deciding what to manufacture for store sales, say, in the Christmas period in its base supply chain with Chinese vendors and long lead times. Likewise, it could retire some existing cash-cow products earlier based on trends it observes on falling orders for stereolithography files. Of course, 'retirement' for a product now would mean only that the product is moved to the bespoke supply chain, potentially available forever for 3-D printing at home.

Barriers to Entry

Certainly there are barriers to a company setting up a high-speed bespoke supply chain to

complement its existing base supply chain. First, companies should be sure they understand *whether* and *how* they stand to benefit from a high-speed bespoke strategy — to enable customized manufacturing, to produce ultra-low-demand parts, or to simply sense the changes in customer demand patterns much earlier than they do now.

Next is the issue of additional investment. The direct cost of outfitting asset-light, 3-D printing facilities is low compared with the capital costs for traditional factories. But significant learning costs can arise related to adopting new technologies and a new supply chain model.

Another barrier is operational: 3-D printers — supplemented with other highly flexible and automated manufacturing equipment such as robots — must be able to actually make the company's products or at least components that lend themselves to quick-and-easy assembly. At present, Daimler is offering 3-D printed plastic spare parts but not, say, replacement gearboxes or engines. This obstacle will lessen over time as 3-D printing capabilities improve – already we see a wide spectrum of capability from 3-D printed chocolate cakes to 3-D printed cement office buildings.

And then there is distribution. Most manufacturers are accustomed to delivering in bulk at low cost across long distances, with speed often a secondary concern. High-speed bespoke supply chains flip this model on its head. They are short in distance, light in volume, and offer quick delivery. The last mile of a high-speed bespoke supply chain resembles Amazon Prime more than any traditional manufacturing or wholesale delivery

system.

The solution for most companies building high-speed bespoke supply chains is not to develop distribution on their own. Instead, they could either piggyback onto the efficient in-country infrastructure already built by e-commerce leaders like Amazon.com Inc., Alibaba Group, and, increasingly, Google Inc., or outsource to in-country local delivery services given the short delivery distances. Or, manufacturers could retain operational control, for example, by using an Uber-like app – that Amazon plans to launch – to find individual drivers for last-mile deliveries.

While the financial and operational barriers to launching a high-speed bespoke supply chain are not trivial, they are modest in comparison to what it took companies to build their legacy manufacturing and distribution networks. Companies would be wise to ride this newest wave of digital customer engagement and consider not only how adding a high-speed bespoke supply chain could improve their existing business but also what new businesses and business models benefitting local economies such a supply chain would enable.